Declaration of Wendi Goldsmith

Pursuant to 28 U.S.C. § 1746, I, Wendi Goldsmith, declare the following based upon my personal knowledge:

1. My name is Wendi Goldsmith. I am 55 years old and competent to testify to all facts contained in this declaration. I submit this declaration in support of Conservation Law Foundation ("CLF")'s Comments on the United States Environmental Protection Agency ("EPA")'s Draft Permits for the (i) Sprague Quincy Terminal, Permit #MA0020869 ("Sprague Quincy Permit") and Sprague Twin Rivers Technology Terminal, Permit #MA0028037 ("Sprague TRT Permit") (collectively "Draft Permits").
2. I have over thirty years of experience applying earth science principles to sustainable and disaster resilient planning, development, and natural resource restoration, much of which involved critical infrastructure protection and sensitive facilities. I have led research and development programs for the U.S. Department of Defense, developing methods for evaluating and optimizing renewable energy and efficient/resilient buildings, infrastructure, and site design. I led the technical development of the Broad Meadows Marsh Preliminary Restoration Plan which lies across the Town River from Sprague Quincy Terminal; work was performed under contract to the US Army Corps of Engineers and was subsequently implemented by others. I played a lead role on the planning, design, and program management of the $14 billion post-Katrina Hurricane Storm Damage Risk Reduction System, the first regional-scale climate adapted infrastructure system in the US and winner of top national awards from the American Society of Civil Engineers, the American Council of Engineering Companies, and others. I have also written and presented extensively on climate change resilience in urban settings, and frameworks for decision-making under risk and uncertainty,

including book chapters, peer reviewed articles, reports, formal seminars for multiple public agencies and academic institutions including Harvard Graduate School of Design, Metropolitan Transit Authority of New York, U.S. Army Corps of Engineers, and more. Given this extensive experience, I have expertise in the practical application of climate science in the built environment.

3. I received a *Doctor in Philosophy (PhD)* in Climate Resilience Science, Engineering, Economics and Business from Aarhus University in Denmark in 2016. I received a *Master of Science* from the University of Massachusetts at Amherst in Plant and Soil Science in 2002 and a *Master of Arts* from the Conway School in Ecological Land Planning Design in 1990. I received dual *Bachelor of Arts* degrees from Yale University in Earth & Planetary Sciences and Studies in the Environment in 1988. I am a Licensed Professional Geologist in New Hampshire and Louisiana, and a Certified Professional Geologist by the American Institute of Professional Geologists. I am a Certified Professional in Erosion and Sediment Control and a Certified Profession in Stormwater Quality by EnviroCert International.

4. In 1992, I founded Bioengineering Group, where I served as CEO until its sale in 2014. The mission of Bioengineering Group was to build sustainable communities on an ecological foundation. As CEO, I led the planning, permitting and design of large-scale infrastructure projects such as renewable energy generation, highways, stormwater management systems, flood control facilities, and parks/greenways, as well as contaminated properties, including Superfund sites. I also acted as an advisor for site development and infrastructure projects regarding sustainable development methods suitable to changing climate and land use patterns. Prior to founding Bioengineering Group, I was an Environmental Planner at Charles T. Main Inc. from 1990 to 1991, where I conducted site investigations, worked on project

planning and design, and prepared permit applications for utility corridors, hazardous materials cleanup and restoration, and solid waste containment and revegetation. I then worked as a Fluvial Geomorphologist for Bestmann Ingenieurbiologie GmbH in 1991, performing ecological restorations of rivers, streams, wetlands, coastal areas, and reservoirs in Germany.

5. I have worked on disaster resilience infrastructure projects across and outside the country for a diverse range of clients. A few examples include:
    a. Following Hurricane Sandy, I was selected to review climate science and geomorphology best practices in relation to disaster recovery and resilient infrastructure improvements for LaGuardia Airport in New York, New York for two terminals operated by Delta Airlines. The project aimed to examine vulnerabilities and risks, identify appropriate mitigation measures and costs, and implement solutions that incorporated green infrastructure measures.
    b. When a cluster of hurricanes affected the Gulf of Mexico shortly after commencement of engineering for the Panama Canal Expansion Project, I was tapped by the design team to lead an interdisciplinary review to ensure use of globally recognized practices for engineering with regard to climate change and disaster resilience. Under my guidance, the team identified several deficiencies which generally related to failure to address threats and vulnerabilities due to combined events, cascading cause-effect processes, and known forecasts of environmental conditions anticipated during the project's service life. Specific recommendations were made to address improvements of the design to remedy these deficiencies.
    c. I led the Federal Reserve Bank Climate Risk Study in Boston, Massachusetts, which

evaluated the risk from sea level rise and storm surge to its property in downtown Boston. The main gap in then-current understanding of facility vulnerability was the high potential for existing stormwater infrastructure to operate in reverse (bringing water into the site, rather than conveying it away) or to entirely rupture/collapse due to age and degraded condition during combined heavy rainfalls and high water levels in Boston Harbor. Study recommendations included increasing resilience through redundant measures including the construction of a stormwater "barricade" system, as well as modification/relocation of the facility's existing mechanical systems.

d. I integrated climate science into New Orleans' Hurricane and Storm Damage Risk Reduction System (HSDRRS) in Louisiana, a monumental undertaking to reduce flood vulnerability using multiple lines of defense surrounding New Orleans and its neighboring Parishes. Started in 2006, the project is the nation's first infrastructure system accounting for climate change adaptation and resilience, and it resulted in approximately $30 billion in prevented damages during Hurricane Isaac in 2012. Unlike the multi-billion-dollar set of infrastructure elements before Katrina, the rapidly planned, designed, and constructed HSDRRS did not rely merely on hindward-looking data as the basis of design. Instead, it systematically defined and applied known trends in sea level rise, local land subsidence rates, and storm patterns (rainfall, wind speed, wind field size, and more) to encompass predicted future conditions throughout the intended service life of the project. The project resulted in adoption of new protocols for multi-parameter forecast-based engineering guidance by the US Army Corps of Engineers, effectively setting the standard in the US for such work.

e. I led an Energy Quality Flow Analysis for Ultra-Low Communities for multiple Army installations seeking to reduce their vulnerability to loss of operations, while simultaneously improving their greenhouse gas footprint and reducing operating costs throughout facility life. Threats include changing climate conditions capable of shifting technical requirements and posing operational interruptions, as well as potential military contingency and terrorist incidents. The project identified cost-effective and risk-resilient energy choices, focusing on thermal energy through combined wastewater, district heating/cooling, and on-site renewables.

f. I led a Disaster Resilient Infrastructure Training Program for the Metropolitan Transportation Authority/New York City Transit to address recovery, disaster resilience and climate change factors following Hurricane Sandy. I ultimately researched and updated design team managers regarding global best practices for tunnel and rail flood mitigation, and then recommended suitable climate change factors to guide design based on then-current data and federal policy. The information aided the management team to identify specific deficits and feasible remedies to better coordinate multiple repairs and new construction elements in and around the New York City Subway System after it sustained billions in damages from Hurricane Sandy.

6. Outside of my career, I have dedicated myself to public service. In 1999, I co-founded the Center for Urban Watershed Resilience, a non-profit organization revitalizing the ecological, economic and social value of degraded urban sites. I have been a Board Director for the Center since its founding and currently serve as President. From 2008 to 2012, I served as a federal appointee to the National Women's Business Council. I have been on the

International Council of Advisors for the Asian University of Women since 2010. From 2014 to 2020 I served as Board Director for the Soil and Water Conservation Society, where I remain an active member. I am also a Fellow and lifetime member of the Society of American Military Engineers. In 2016, the American Association of Engineering Societies and National Audubon Society awarded me the Joan Hodges Queneau Palladium Medal. I am also a 2012 recipient of the Bronze Order of the De Fleury Medal for inspirational leadership to the Army Engineer Regiment.

I. EVALUATION OF THE DRAFT PERMIT FOR THE SPRAGUE TERMINALS

7. I am familiar with the EPA's Draft Permits for the Sprague Quincy Terminal and Sprague TRT Terminal (the "Terminals"). In particular, I have reviewed Section I.C.1.b.6 ("Major Storm Events BMP") and the associated request for comment (page 36 of Sprague TRT Permit Fact Sheet and page 37 of Sprague Quincy Fact Sheet) ("Request for Comment").
8. As explained fully below, the Draft Permits maintain language from prior permits requiring consideration of climate change. These provisions include, for example: disclosure of information relevant to design, operation and maintenance of facilities in the possession of regulated entities (as well as hired professional consultants such as engineers); identification of potential spill and discharge locations associated with flooding, run-on events such as storm surge and wave action, as well as surface runoff or flows that exceed the capacity of existing drainage infrastructure; engineer's and operator's certifications; design, operation and maintenance based on duties of care such as "good engineering practice," and annual update of SWPPPs based on available data. All of these provisions have long served as the regulatory foundation of the structure of the Draft Permits and, given the high level of scientific consensus and available data and modeling, have required and continue to require

full consideration of climate change related impacts.

9. Though the proposed language for I.C.1.b.6 does not directly remove or alter the requirements throughout the Draft Permits that the Terminals use "good engineering practices" in designing the facility and preparing for severe weather events, its narrow and inadequate focus would constitute prohibited "back-sliding" if adopted in the final permit because it would narrowly constrain existing permit language requiring consideration of the well-documented current and increasing impacts of climate change. Proposed Section I.C.1.b.6 would need to be significantly strengthened or revert to the earlier permit language to conform to the regulatory standard required.

A. Site Visits to visually assess both Sprague Terminals in Quincy, MA in contemplation of Draft Permits

10. I visited and photographed the areas adjoining the two Terminals on 11 January 2021 to characterize basic facilities. I conducted a follow up site visit near low tide on 27 January 2021 to better document shoreline conditions when viewed from across the Town River. Site visit photodocumentation covers both Sprague facilities in Quincy, MA, plus the general conditions of the waterfront along the Town River. In summary, both Terminals operated by Sprague in Quincy, MA store, handle, and/or process hydrocarbons in close proximity to residential and recreational areas with heavy public use and high habitat functions. Multiple marinas, small boat access points, playgrounds, athletic fields, community walking paths, and publicly accessible open space on both banks of the Town River draw people to the area beyond local residents. Shellfishing indicators were noted including stored lobster traps and active clam digging (observed multiple shell fisherman the afternoon of 27 January). Significant migratory waterfowl were observed including geese and ducks. Meanwhile, no evidence of recent updates to terminal facilities was

observed, and indeed evidence of inadequate performance was readily apparent. The bottom line is that increasing climate related threats combined with increasing levels of exposure heighten risk of harm to human health and the environment.

1. <u>Sprague Quincy Terminal Photodocumentation</u>

11. Below, viewed from the federal ecosystem restoration site at Broad Meadows Marsh park across the Town River, the spatial relationship of the Sprague Quincy terminal to the abutting waterfront/marina apartment complex (left) and the Town River Marina (right) is clear. The Terminal is surrounded by diverse habitats and recreational activities.

12. Below, viewed from across the Town River from another marina, the marina adjoining the apartment complex is visible to the east of the tank area. The dense tree canopy surrounding much of the terminal is evident also.

13. Below is a photograph viewed from the extensive public park and habitat complex at Broad Meadows Marsh across the Town River. The Sprague Quincy Terminal tanks are visible behind their containment berm.

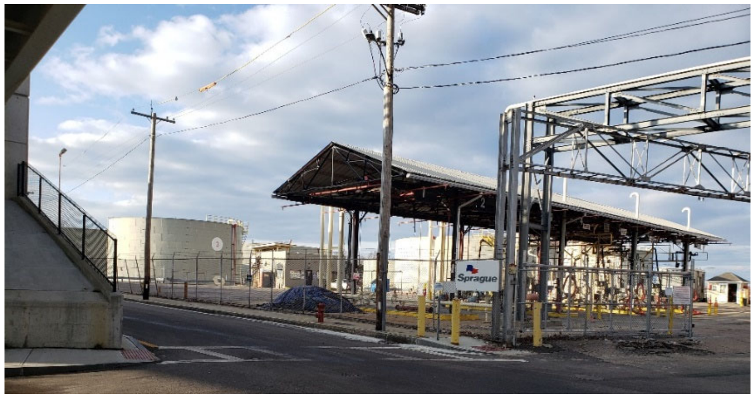
14. Below is a photograph of the dock and rock armor along the containment berm dating to the late 1970s (per permit records). The vivid demarcation of snow and wet rock indicates the 27 January high tide elevation. Adjacent apartment building is visible beyond.

15. Below is a photograph of open space and coastal habitats approximately 250 feet west of Sprague Quincy Terminal beyond Town River Marina showing lobster trap storage and saltmarsh across Town River.

16. Below is a photograph of granite-walled tributary connecting to the Town River roughly 800 feet west of the boundary of Sprague Quincy Terminal, showing open space and meadow habitat, with lobster trap storage beyond.

2. Sprague Twin Rivers Technology Terminal Photodocumentation

17. Below, entrance gate with tanks beyond. The abutment to the Fore River Bridge is visible on the left of the frame as the entrance gate requires driving beneath the bridge span.



18. Below, same entrance gate viewing straight into facility with Twin River Technology brick building visble on right.

19. Below, view of Twin Rivers Technology Terminal from park and playground across Town River. Brick TRT buildings are near the entrance gate, and large light green storage tank visible on right is one of ten at the Sprague facility.

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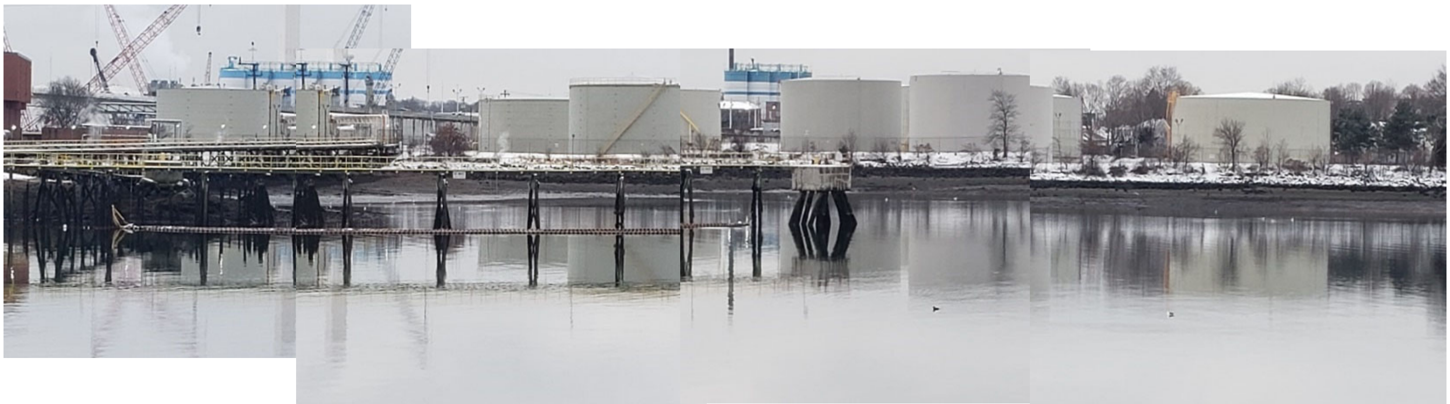
20. Below, view from Wharf St across corner of tank area into residential neighborhood to the north. Note some visual buffer is provided by mature tree canopy.

21. Below, tiled photographs showing dock in foreground, corner of TRT brick building and Fore River Bridge span and north abutment visible behind gray tanks. Area of large tanks extends to mature trees bordering Dee street neighborhood and its waterfront park (which is out of the frame to the right).



22. Below, waterfront park area with concrete seawall terminated at property boundary of Sprague TRT Terminal showing tank farm area at right and brick TRT facility, tanks, and dock beyond. Intertidal flats contain angular large stone and gravel materials which appear to have tumbled out of rock revetment originally placed in line with concrete seawall. Trees and shrubs are established roughly above the area of remaining scattered stone which shows visible erosion and an estimated minimum of 10 feet of retreat since construction.

23. Below, the containment berm is unstable and has an irregular upper surface which is visibly settling and/or eroding. Looking along the fenceline, scalloped ground surface areas indicate where erosion has caused focused spots of material loss of the containment berm exposed to shoreline storm impacts.

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24. Below, viewing the fenceline from a different angle reveals the tilted fence posts and wobbling alignment indicative of berm instability due to erosion. It is likely that storm events such as the 2018 set of four winter Nor'easters created storm surge and wave conditions capable of overtopping the berm and/or slamming the fence with marine flotsam which would be capable of significant damage to the berm and its ability to provide reliable containment. Brick buildings of the TRT facility are visible beyond.

B. Climate Change Is A Major Threat to Infrastructure, as Recognized by Government, Industry, and Engineers

25. It is beyond rational dispute that climate change has already caused dramatic changes in regional precipitation, increased the frequency and severity of precipitation events and storms, increased the frequency and severity of potentially catastrophic tropical storms including related storm surges and flooding, caused and contributed to sea level rise, and dramatically shifted air, water and surface temperature patterns. Further, these documented current impacts will continue and increase into the future both near and long term even if global emissions are stabilized immediately. Moreover, they will increase significantly to the extent current increasing emissions trends are not substantially curtailed. It is

indisputable that the climate change poses substantial risks to long design-life public and private infrastructure and other complex facilities, like the Terminals.

26. Within the Federal government, procedures and actions have become increasingly common to reassess, identify, and remedy deficiencies in project design and implementation, now that scientific consensus and relevant government policy is clear about how natural disaster impacts influenced by climate change pose substantial (and increasing) threats to public and private assets as well as public health and safety and the environment.

27. In a recent legal brief filed in federal court, the United States stated: "Climate change poses a monumental threat to Americans' health and welfare by driving long-lasting changes in our climate, leading to an array of severe negative effects, which will worsen over time." *Juliana v. U.S.*, No. 6:15-cv-01517, ECF No. 74.

28. The United States Global Climate and Health Assessment Report found that:

> Climate change projections show that there will be continuing increases in the occurrence and severity of some extreme events by the end of the century, while for other extremes the links to climate change are more uncertain. Some regions of the United States have already experienced costly impacts—in terms of both lives lost and economic damages (see Figure ES5)—from observed changes in the frequency, intensity, or duration of certain extreme events (see Table 1 in Ch 4: Extreme Events). While it is intuitive that extremes can have health impacts such as death or injury during an event (for example, drowning during floods), health impacts can also occur before or after an extreme event, as individuals may be involved in activities that put their health at risk, such as disaster preparation and post-event cleanup. Health risks may also arise long after the event, or in places outside the area where the event took place, as a result of damage to property, destruction of assets, loss of infrastructure and public services, social and economic impacts, environmental degradation, and other factors. Extreme events also pose unique health risks if multiple events occur simultaneously or in succession in a given location. The severity and extent of health effects associated with extreme events depend on the physical impacts of the extreme events themselves as well as the unique human, societal, and environmental circumstances at the time and place where events occur.

U.S. Global Change Research Program, Climate and Health Assessment Report, Chapter 4:

Extreme Events, Summary (https://health2016.globalchange.gov)

29. EPA's 2009 endangerment finding concluded:

> The evidence concerning how human induced climate change may alter extreme weather events also clearly supports a finding of endangerment, given the serious adverse impacts that can result from such events and the increase in risk, even if small, of the occurrence and intensity of events such as hurricanes and floods. Additionally, public health is expected to be adversely affected by an increase in the severity of coastal storm events due to rising sea levels.

Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66,496, 66,497–98 (Dec.15, 2009).

30. In addition, it states:

"Overall, the evidence on risk of adverse impacts for coastal areas provides clear support for a finding that greenhouse gas air pollution endangers the welfare of current and future generations. The most serious potential adverse effects are the increased risk of storm surge and flooding in coastal areas from sea level rise and more intense storms. Observed sea level rise is already increasing the risk of storm surge and flooding in some coastal areas."

Id. at 66,498.

31. Addressing sea level rise, the Endangerment Finding states:

> Although increases in mean sea level over the 21st century and beyond will inundate unprotected, low-lying areas, the most devastating impacts are likely to be associated with storm surge. Superimposed on expected rates of sea level rise, projected storm intensity, wave height, and storm surge suggest more severe coastal flooding and erosion hazards. Higher sea level provides an elevated base for storm surges to build upon and diminishes the rate at which low-lying areas drain, thereby increasing the risk of flooding from rainstorms. In New York City and Long Island, flooding from a combination of sea level rise and storm surge could be several meters deep. Projections suggest that the return period of a 100-year flood event in this area might be reduced to 19–68 years, on average, by the 2050s, and to 4–60 years by the 2080s. Additionally, some major urban centers in the United States, such as areas of New Orleans are situated in low-lying flood plains, presenting increased risk from storm surges.
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> The Administrator finds that the most serious risk of adverse effects is presented by the increased risk of storm surge and flooding in coastal areas from sea level rise. Current observations of sea level rise are now contributing to increased risk of storm surge and flooding in coastal areas, and there is reason to find that these areas are now endangered by human-induced climate change.

Id. at 66,533.

32. The U.S. EPA states that:

> Sea level rise, heavy precipitation, and storm surge are expected to increase flooding and coastal erosion, and put further strain on aging infrastructure in the Northeast. Millions of Northeastern residents live near coastlines and river floodplains, where they are potentially more vulnerable to these climate-related impacts. During storm events with heavy precipitation, combined sewer-stormwater systems in this region can overload, resulting in wastewater discharge into bodies of water used for recreation or drinking water and creating health risks.

U.S. EPA "Climate Change in the Northeast" Webpage, *available at* https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-northeast_.html#Reference%201.

33. A recent journal article published "by researchers at the National Oceanic and Atmospheric Administration and the University of Wisconsin at Madison, analyzed satellite data over the last 40 years and found that planetary warming during that period increased the likelihood of a tropical cyclone become a major hurricane — Category 3 strength or higher — by approximately 8% per decade." Chris D'Angelo, *Climate Change Is Fueling Stronger Hurricanes, Federal Study Finds*, HUFFPOST.COM (May 19, 2020), https://www.huffpost.com/entry/hurricanes-climate-change-noaa-study_n_5ec3e9ecc5b68a8b77d88276. The article noted:

> Over the past 40 y (and longer), anthropogenic warming has increased sea surface temperature (SST) in [tropical cyclone]-prone regions (22⇓–24), and, in combination with changes in atmospheric conditions, this has increased [tropical cyclone] potential intensity in these regions . . . . Based on physical understanding and robust support from numerical simulations, an increase in environmental potential intensity is expected to manifest as a shift in the [tropical cyclone] intensity distribution toward greater intensity and an increase in mean intensity.

The greatest changes are found in the North Atlantic, where the probability of major hurricane exceedance increases by 49% per decade, significant at greater than the 99% confidence level . . . .

Kossin, James P., Knapp, Kenneth R., *et al.*, *Global increase in major tropical cyclone* *exceedance probability over the past four decades*, PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, 2–3 (Apr. 10, 2020).

34. The United States' Climate and Health Assessment Report concluded:

> Existing infrastructure is generally designed to perform at its engineered capacity assuming historical weather patterns, and these systems could be more vulnerable to failure in response to weather-related stressors under future climate scenarios.,, Shifts in the frequency or intensity of extreme events outside their historical range pose infrastructure risks, which may be compounded by the fact that much of the existing critical infrastructure in the United States, like water and sewage systems, roads, bridges, and power plants, are aging and in need of repair or replacement., For example, the 2013 American Society of Civil Engineer's Report Card assigned a letter grade of D+ to the condition and performance of the Nation's infrastructure.

U.S. Global Change Research Program, Climate and Health Assessment Report, 4.3 Disruption of Essential Infrastructure, *available at* https://health2016.globalchange.gov/extreme-events.

35. The Government Accountability Office's Climate Information Report stated:

> Over the last decade, the federal government incurred over $300 billion in costs due to extreme weather and fire, according to the President's 2016 budget request. Costs are expected to grow as rare events become more common and intense due to climate change, according to the National Academies.
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The federal government recognizes the need to account for climate change risks in its planning and programs and has begun calling on agencies to take certain actions.

GAO Report to Congressional Requesters, Climate Information: A National System Could Help Federal, State, Local, and Private Sector Decision Makers Use Climate Information (Nov. 2015) *available at* https://energycommerce.house.gov/sites/democrats.energycommerce.house.gov/files/GAO%20Report%20FINAL--Climate%20Information%2012-8-15.pdf.

36. The Third National Climate Assessment found that "[i]nfrastructure is being damaged by sea level rise, heavy downpours, and extreme heat; damages are projected to increase with continued climate change." J. M. Melillo et al. eds., *Third Nat'l Climate Assessment*, at 15 (2014), and "Infrastructure will be increasingly compromised by climate-related hazards, including sea level rise, coastal flooding, and intense precipitation events," *id.* at 379. It

further explained:

> Heavy downpours are increasing nationally, especially over the last three to five decades, with the largest increases in the Midwest and Northeast. Increases in the frequency and intensity of extreme precipitation events are projected for all U.S. regions. [High Confidence]
>
> The intensity, frequency, and duration of North Atlantic hurricanes, as well as the frequency of the strongest hurricanes, have all increased since the 1980s [High Confidence]. Hurricane intensity and rainfall are projected to increase as the climate continues to warm [Medium Confidence].
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> In the next several decades, storm surges and high tides could combine with sea level rise and land subsidence to further increase coastal flooding in many regions. The U.S. East and Gulf Coasts, Hawaii, and the U.S.-affiliated Pacific Islands are particularly at risk.
>
> Winter storms have increased in frequency and intensity since the 1950s, and their tracks have shifted northward [Medium Confidence]. Future trends in severe storms, including the intensity and frequency of tornadoes, hail, and damaging thunderstorm winds, are uncertain and are being studied intensively [Low Confidence]."

Melillo, J. M., T. (T. C.) Richmond, and G. W. Yohe, eds., 2014: Climate Change J. M. Melillo et al. eds., *Third Nat'l Climate Assessment*, at 841 (2014)

1. <u>Private Industry</u>

37. Private industry similarly recognizes the danger that climate change poses to their infrastructure, human health, and the environment.

38. As early as the 1970s, experts at ExxonMobil recognized the link between carbon dioxide and climate change: "[T]here is general scientific agreement that the most likely manner in which mankind is influencing the global climate is through carbon dioxide release from the burning of fossil fuels." Neela Banerjee, *et al.*, *Exxon's Own Research Confirmed Fossil Fuels' Role in Global Warming Decades Ago*, INSIDE CLIMATE NEWS (Sept. 16, 2015), *available at* https://insideclimatenews.org/news/15092015/Exxons-own-research-confirmed-fossil-fuels-role-in-global-warming.

39. ExxonMobil has stated that the "company [ ] engineers its facilities and operations robustly

with extreme weather considerations in mind. Fortification to existing facilities and operations are addressed, where warranted due to climate or weather events, as part of ExxonMobil's Operations Integrity Management System." Energy and Carbon – Managing the Risks, at 14, http://www.lawandenvironment.com/wp-content/uploads/sites/5/2014/04/Report-Energy-and-Carbon-Managing-the-Risks1.pdf.

40. Royal Dutch Shell states in its 2016 Sustainability Report:

> [t]he effects of climate change mean that governments, businesses and local communities are adapting their infrastructure to the changing environment. At Shell, we are taking steps at our facilities around the world to ensure that they are resilient to climate change. This reduces the vulnerability of our facilities and infrastructure to potential extreme variability in weather conditions.
>
> We take different approaches to adaptation for existing facilities and new projects. We progressively adjust our design standards for new projects while, for existing assets, we identify those that are most vulnerable to climate change and take appropriate action.

Royal Dutch Shell plc, Sustainability Rep., at 19 (2016), https://reports.shell.com/sustainability-report/2016/servicepages/download-centre.html. The report further states that "Shell has a rigorous approach to understanding, managing and mitigating climate risks in our facilities." *Id.*

41. BP is working with risk modeling firm Jupiter to "predict future flood and wind gust risk for coastal, inland, and offshore facilities" associated with climate change. https://jupiterintel.com/customers/.

42. The DuPont company's official Statement of Climate Change recognized that "urgent action" is necessary to address climate change:

> "The global scientific community is united in recognizing the urgent need to address greenhouse gas (GHG) emissions because of the role they play in climate change, a real and rapidly growing threat to society and the planet. The impact of climate change is already widespread across both human populations and natural ecosystems. Addressing climate change, and the GHG emissions that contribute to it, requires urgent action and long-term commitments by every segment of society, including the business community. Strategies to reduce GHG emissions, such as setting and meeting aggressive reduction goals, are far more effective over

> time than attempting to remediate each natural and humanitarian disaster that results from climate change. A combination of technology innovation, market-based policies and evolving consumer habits are necessary to reduce GHG emissions and achieve global climate goals, such as those outlined in the Paris Agreement and Intergovernmental Panel on Climate Change (IPCC) reports."

DuPont de Nemours, Inc. Statement on Climate Change, https://www.dupont.com/position-statements/climate-change.html.

43. These actions include the necessity for climate mitigation: "We are committed to bringing our best thinking, fervent action and scientific innovations to market, supporting both the mitigation and adaptation actions needed to address the impacts of climate change." *Id.*

44. Chemical manufacturer Arkema has stated publicly, "The Earth is getting warmer! The phenomenon of climate disruption and its origin are now no longer in question." COP21: Arkema is committed to climate, https://www.arkema.com/en/social-responsibility/cop21/.

45. Chairman of the Board for Bayer, Werner Baumman, has stated, "Climate change has become a concrete threat to life on Earth." Bayer Sustainability Report 2019, 10, https://www.bayer.com/en/sustainability-reports.aspx.

46. The Bank of England recognizes climate change as a necessary factor to consider when determining risk.

> Physical risks from climate change manifest themselves in changes to both the frequency and severity of specific weather events (such as heatwaves, floods, wildfires and storms) and, in the longer term, broader shifts in climate such as changes in precipitation and extreme weather variability, sea level change and rising average temperatures (IPCC, 2014).
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> Losses related to physical risk factors directly affect insurance firms' liabilities through higher claims, and physical risks may extend beyond the immediate impact of natural catastrophes, for example through the disruption of supply chains.
>
> The report recognises the challenge of assessing these financial impacts on general insurers' liabilities. Weather-related risk estimates under current climatic conditions already contain significant uncertainty; this uncertainty is exacerbated when estimates are projected to reflect possible future climatic conditions. This

report takes as a key premise that business decisions that are impacted by climate change can be informed by attempts to assess related risks despite the implicit uncertainty.

Bank of England, *A framework for assessing financial impacts of physical climate change*, 4 (May 2019), https://www.bankofengland.co.uk/-/media/boe/files/prudential-regulation/publication/2019/a-framework-for-assessing-financial-impacts-of-physical-climate-change.pdf?la=en&hash=2676FF477911CA0EB39E62D6F672FCD2162BD2BC#page=10.

47. "Climate change is therefore a central issue to consider and is widely seen as one of the biggest threats to a sustainable future. The steady rise in human activity – and the subsequent greenhouse gas emissions – witnessed since the industrial revolution has already had a considerable and measurable impact on our planet." Bank of England, *Climate change: why it matters to the Bank of England*, https://www.bankofengland.co.uk/knowledgebank/climate-change-why-it-matters-to-the-bank-of-england.

48. BlackRock also sees climate change as a compulsory consideration in any future planning.

> The evidence on climate risk is compelling investors to reassess core assumptions about modern finance. Research from a wide range of organizations – including the UN's Intergovernmental Panel on Climate Change, the BlackRock Investment Institute, and many others, including new studies from McKinsey on the socioeconomic implications of physical climate risk – is deepening our understanding of how climate risk will impact both our physical world and the global system that finances economic growth.
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> A pharmaceutical company that hikes prices ruthlessly, a mining company that shortchanges safety, a bank that fails to respect its clients – these companies may maximize returns in the short term. But, as we have seen again and again, these actions that damage society will catch up with a company and destroy shareholder value.

Letter from BlackRock CEO Larry Fink to CEOs: A Fundamental Reshaping of Finance, https://www.blackrock.com/corporate/investor-relations/larry-fink-ceo-letter.

49. "The need is particularly urgent for cities, because the many components of municipal

infrastructure – from roads to sewers to transit – have been built for tolerances and weather conditions that do not align with the new climate reality. In the short term, some of the work to mitigate climate risk could create more economic activity. Yet we are facing the ultimate long-term problem." *Letter from BlackRock Global Executive Committee to BlackRock Clients: Sustainability as BlackRock's New Standard for Investing*, https://www.blackrock.com/corporate/investor-relations/blackrock-client-letter.

2. Engineers

50. The American Society of Civil Engineers supports both "[g]overnment policies that encourage anticipation of and preparation for impacts of climate change on the build environment," "[r]evisions to engineering design standards, codes, regulations and associated laws that strengthen the sustainability and resiliency of infrastructure at high risk of being affected by climate change," and "[i]dentifying critical infrastructure that is most threatened by changing climate in a given region and informing decision makers and the public." ASCE Policy Statement 360.

51. ASCE recognizes that "Climate change poses a potentially serious impact on worldwide water resources, energy production and use, agriculture, forestry, coastal development and resources, flood control and public infrastructure." ASCE Policy Statement 360.

52. ASCE also recognizes "Climate extremes such as floods and droughts and other significant variations in hydrologic patterns that may necessitate changes or additions to flood control and public infrastructure in order to provide adequate public safety and sustainable performance."

53. ASCE concludes:

> Civil engineers are responsible for the planning, design, construction, operations and maintenance of physical infrastructure, including buildings, communication

> facilities, energy generation and distribution facilities, industrial facilities, transportation networks, water supply and sanitation systems, and water resources facilities. and urban water systems. Most infrastructure typically has long service lives (50 to 100 years) and are expected to remain functional, durable and safe during that time. These facilities are exposed to and often are vulnerable to the effects of extreme climate and weather events. Engineering practices and standards associated with these facilities must be revised and enhanced to address climate change to ensure they continue to provide acceptably low risks of failures and to reduce vulnerability to failure in functionality, durability and safety over their service lives.

ASCE Policy Statement 360.

54. ASCE's 2017 Infrastructure Report Card concluded that "The concentration of [oil and gas] processing plants on the shores of southern states creates significant exposure to future storm and climate change impacts." 2017 Infrastructure Report Card at 43.

55. ASCE also notes:

> Periodic oil and gas pipeline leaks and failures present risks to the environment and the public. Most domestic oil refineries are situated along the coasts, subjecting them to risks from receding shorelines, climate change, and storm-related impacts. Each time there is a pipeline break or refinery outage, prices spike and supply is disrupted, with even minor disruptions having immediate impact. Statistics maintained by the PHMSA indicate that the frequency of significant pipeline incidences has remained flat in recent years; however, each incident typically results in injuries and/or deaths, environmental impacts, and regional economic disruption. Meanwhile, the number of reported "spill" events has increased in the last several years, up from 573 in 2012 to 715 in 2015, and events such as multiple leaks at the Aliso Canyon gas storage field in California and Colonial gasoline pipeline failures in Alabama have highlighted system fragility and prompted federal rulemaking.

2017 Infrastructure Report Card at 44.

Impacts of more intense storms, increased flooding, and rising sea levels may jeopardize a large number of constructed remedies at Superfund sites. EPA's inventory of Superfund sites shows that over 500 Superfund sites are within a 100-year floodplain or at an elevation less than 6 feet above mean sea level, and it is likely that a portion of the engineered systems in place at these sites are vulnerable.

Id. at 52.

56. In 2019, ASCE issued a new Manual of Practice, MOP-140, entitled "Climate-Resilient

Infrastructure: Adaptive Design and Risk Management."

57. Similar to ASCE, ASTM International has published a Standard Guide for Climate Resiliency Planning and Strategy, providing guidance on resilience strategies to protect, among other things, infrastructure lying in floodplains. ASTM E3032-15e1.

58. The prominent infrastructure engineering firm AECOM has warned about the substantial risks posed by climate change:

> The growing intensity and frequency of severe storms, flooding and storm surges, extreme temperature events, droughts, firestorms, and sea-level rise on every continent have had major impacts on global populations and infrastructure. Over the past 20 years, these natural hazards have demonstrated a widespread lack of business preparedness and limited ability to respond to threats to business assets, operations, raw materials, power and water supplies, supply chains — and ultimately, economic viability.

AECOM Press Release, https://aecom.com/press-releases/climate-change-and-adaptation-experts-detail-strategies-in-preparing-for-climate-related-hazards-and-disasters/.

59. AECOM is clear about the importance of building infrastructure resilient to climate change:

> While historic weather data was once a key element in long-term business planning, businesses today must make decisions based on entirely new climate norms and much more extensive climate-related impacts. However, with an understanding of its climate-related risk profile and a plan for integrating resilience into existing business processes, companies can mitigate impacts and recover much more quickly from hazards and disasters.

Id.

60. Many highly-respected engineering firms are specifically marketing climate change mitigation and adaptation services to their clients.

61. The engineering firm Geosyntec has a division focused on climate resilience and adaptation. It notes that:

> Our environment has been experiencing changes in climate patterns in ways that were not anticipated by the designers of our coastal and upland surface-water water management systems.

> Annual rainfall amounts may remain about the same. But instead of falling over long period, it may fall in a shorter period, drastically increasing the likelihood of flooding and altering the performance of existing drainage systems. Meanwhile, other areas are experiencing drought conditions for the first time in modern history.
>
> Upward trends in sea levels, coupled with "king" tides, are causing regular nuisance flooding in many coastal communities. Small increases in sea level can result in large impacts.
>
> Larger, more powerful tropical storms make landfall with greater windspeeds, and storm surges, which overtop seawalls and coastal protections, leaving wide and long trails of destruction.
>
> The resiliency of businesses, cities, institutions, and our infrastructure depends upon a cycle of risk assessment and planning, identification and implementation of adaptative solutions, and evaluation and monitoring during adverse conditions.

Resilience and Adaptation, Geosyntec, https://www.geosyntec.com/markets/resilience-and-adaptation.

62. Engineering firm Exponent has an "extreme-weather-related risk management" practice that focuses on assisting clients with forward-looking climate -change risk modeling. In discussing this work, Exponent explains:

> It is important for corporations and government entities alike to consider a changing, non-stationary set of conditions when assessing and mitigating the risk of infrastructure destruction, business interruption, and consequences of chemical releases that can be caused by extreme weather events. [Exponent]

https://www.exponent.com/knowledge/thought-leadership/2018/12/extremeweatherrelated-risk-management/?pageSize=NaN&pageNum=0&loadAllByPageSize=true.

3. **Discussion/Standards**

63. Known trends in changing rainfall intensity are well explained by climate change models based on observations of historic events. For example, New England has already endured numerous events which are officially recognized as being part of a pattern of extreme weather conditions affected by climate change processes. One of these is the intense storm of 10 July 2010 that already caused discharge of pollutants from a tank farm. The US Geological

Survey, National Oceanographic and Atmospheric Administration, Northeast Climate Science Center, and others haves published findings based on updated statistical methodologies that recent decades of rainfall patterns show a peak 24-hour rainfall intensity which is on the order of 75% higher than prior decades, in essence documenting that rainfall volumes experienced today are already almost twice what they were understood to be in the past, due to climate change.

64. In light of the above, it is clear that risk (which is in turn a function of threat, vulnerability, and consequence) must be managed systematically with future conditions in mind. Any asset/project owner, and by extension any reasonable engineer tasked with design and/or operations of durable infrastructure and other complex facilities, will find it necessary to analyze the potential anticipated climate-change-related threats to the asset throughout its design life. Also vulnerability of the asset should be considered under a comprehensive set of future multi-hazard scenarios, not only those in which so-called "stillwater" inundation occurs due to storm impacts or sea level rise, but also those in which second order effects such as erosion of containment berms, clogging of drainage pipes with debris or flotsam, lack of access due to impassable road networks for operations and response actions, and catastrophic failure such as facilities collapsing or floating off their foundations. Lastly, responsible owners and their engineers must consider not only the intended operations of the facility itself, but also the consequences that may be anticipated to arise from extreme weather impacts, including distribution patterns of contaminants or other offsite, indirect impacts to human health and safety and the environment.

65. The language in Section I.C.1.b.6 of the 2020 Draft Permits does not sufficiently account for major developments in scientific understanding related to many types of change affecting

complex and interdependent natural/built systems where human land use patterns and other impacts inherently alter and shift patterns and processes due to a wide range of factors. These concepts are broader than climate change, *per se*, and reflect what many have characterized as a major scientific revolution in which responsible analysis must include more than a cursory assessment of limited or selective data from the past, but instead must account for risk and uncertainty connected with future conditions which broadly cannot be assumed to resemble historic records, and often are understood through models and forecasts. The highly-cited paper published in Science – Climate Change, "Stationarity Is Dead: Whither Water Management?" (Milly, et al. 2008), provides an accessible treatment of this important topic, and is considered by many professionals to mark a wholesale shift in practice standards related to water resources planning and engineering.

66. Sea level rise combined with storm surge and also wave height additively are capable of contributing to water surface elevations which can cause overtopping, erosion, and other damaging impacts to coastal industrial facilities. Sea level rise is not a distant "theoretical" possibility, but rather a potentially sudden, though short-lived, effect which periodically occurs due to ephemeral shifts in ocean currents which "stall" water flows along the Atlantic US coast, causing it to "back up" at higher water surface elevations. The Miami FL area has experienced several such incidents which caused water surfaces to be 1.5 feet higher than predicted. Due to the low-lying and porous local terrain, these short-lived unpredicted floods placed salt water in contact with pumps and other equipment normally shut down in time to prevent salinity exposure. The costly damage to the equipment affects short- and long-term operability. Throughout the North Atlantic coastline, similar incidents have occurred, though they are frequently difficult for observers to distinguish from variations due to lunar

and wind field effects. This type of effect in the Atlantic Meridional Overturning Circulation (AMOC) flows is understood to become more variable due to several climate change factors, and currently influences water surface elevations up to three feet or more, possibly more in the future under specific circumstances.

67. The combined effects of sea level rise and intensified precipitation patterns, plus erosion and geomorphic shifts in the nearby coastal and riverine corridors, have the potential to affect inland and especially coastal facilities across the US in multiple ways they are unlikely to have factored in during initial design, given the age of many facilities currently operating under CWA permits.

68. Hurricanes Katrina, Rita, Sandy, (and later, Harvey) caused substantial impacts to coastal and inland industrial facilities, with ensuing spread of contaminants, as well as damage to the facilities themselves which interrupted critical industrial supplies (such as fuel for cars, trucks, and back-up generators). The U.S. Army Corps of Engineers was tasked through Federal Law 113-2, Chapter 4, to complete a report detailing the results of a two-year study to address coastal storm and flood risk to vulnerable populations, property, ecosystems, and infrastructure affected by Hurricane Sandy in the United States' North Atlantic region from Virginia through New Hampshire, with an eye towards spotting gaps between how projects were designed in their time, versus what is commonly understood today to be an adequate standard. Known as the North Atlantic Coast Comprehensive Study, it was intended to help local communities better understand the issue of changing flood risks associated with climate change, and to equip them with tools to help prepare for future flood risks. It built on lessons learned from Hurricane Sandy and attempts to summarize and synthesize the latest scientific information available for state, local, and tribal planners. The conclusions of the

study, as detailed in the final report, include several findings, outcomes, and opportunities, such as the use of a nine-step Coastal Storm Risk Management Framework that can be customized for any coastal watershed. The implications of the North Atlantic Coast Comprehensive Study have been widely recognized as clarifying a new framework and generally raising the bar for the practice of engineering specific to coastal risks, with many government and private sector practicing professional regarding it as an excellent encapsulation of current standards of "good engineering practices." I know of no alternative or competing update of engineering guidance which may reasonably be considered more relevant in the context of federal understanding of the issue of "good engineering practices" for addressing coastal risks such as those present at the Sprague terminals in Quincy, MA or other similarly situated facilities.

C. Climate Change is A Major Threat to the Area Around the Terminals in Particular

69. Patterns of waterfront land use along the Town River appear to have shifted significantly during recent decades, as has occurred throughout the Boston Metro region. Many changes involve direct use and access of the water for recreation and fishing activities, as well as for appreciating the beauty of the waterfront and activities such as birdwatching. Namely, segments of the Town River waterfront once used for industrial purposes have been converted for use as small boat marinas, apartment complexes and in-fill housing, athletic fields, playgrounds, walking trails, historic sites marked with interpretive signs, schools, etc. The now-retired dredged material disposal site directly across the river from Sprague Quincy applied millions in federal funds to restore mudflat and saltmarsh habitats in Broad Meadows Marsh and develop a large public park. These changes in land use were sparked in no small part by the success of more than fifty years of applying the Clean Water Act

towards improving formerly degraded urban waterways to a level that now makes them appreciated, valued, and prioritized by local residents. The Town River Bay area can be seen as a success story in slowly and incrementally stewarding the recovery of a formerly ugly, smelly, and unhealthy industrial waterfront.

70. However, the proliferation of water-dependent activities including residential, commercial, and recreation uses has resulted in a new set of consequences from a risk perspective. The human activities and increased habitat value of nearby waterfront areas now collectively represent a set of sensitive receptors to potentially released contaminants. During the early rounds of CWA permitting for the two terminals in Quincy, MA now owned by Sprague, there were far fewer schools or residential neighbors to consider, the general character of Town River Bay was dominated by industrial uses, and people did not visit the area in their recreational time. The neighborhood to the west of Sprague TRT Terminal was tightly segregated by a containment berm topped with mature trees for visual screening. The neighborhood itself was separated from the formerly heavily contaminated Town River by a vertical concrete seawall. Based on such lack of recognized exposure pathways for contaminants to affect people, the consequences of pollutant releases was demonstrably lower in terms of risk to human health and the environment. Present patterns of use around the waterfront areas of Town River Bay demonstrate substantially higher levels of exposure than existed previously. Without adequate care in terms of actions to suitably upgrade the two Sprague terminals based on good engineering practices, the consequences of a catastrophic release would be far greater now than in the past.

71. Furthermore, the majority of land use changes represent various forms of retreat (of buildings and other fixed features) from vulnerable shoreline areas, instead opening up

waterfront settings to open space, restored marshland, seasonal marina floats, etc. Even the dense apartment developments along the Town River estuary adopted a development pattern where buildings are set back from the shore, while lawns and athletic amenities occupy the most flood prone zones. It appears that the shifts in land use patterns have improved the overall climate resilience of the community, and as such, appear to be consistent with current practices recommended by federal authorities and other public and private experts.

72. Meanwhile, there is no visible evidence that either of the Terminals owned by Sprague along the Town River in Quincy has been similarly adapted to improve climate resilience of the facilities. The Sprague Quincy Terminal shows no apparent weakening from erosion, in contrast to the Sprague TRT Terminal. Also, the Sprague Quincy Terminal appears to occupy a more sheltered position further up the Town River estuary than the other Terminal. Hence, its exposure seems lower in terms of risks of flooding and erosion than the older and less sheltered Sprague TRT Terminal. The design and construction of the Quincy Terminal's shore fronting measures occurred in the 1970s, so it is reasonable to expect that the materials and methods applied then reflected the evolving good engineering practices at that time. However, to what extent the operation, repairs, and updates to that facility have kept up with good engineering practices since that time remain unclear, and no evidence of upgrades was observed.

73. The infrastructure at the Sprague TRT Terminal is far older and reflects early industrial waterfront customs. The overall condition and maintenance level at the shoreline zone of the Sprague TRT tank farm area appeared quite poor. The most concerning observations involved a poorly protected coastal embankment along the seaward edge of the main containment berm system for its high-volume tank farm. The obvious signs of erosion and

instability were underscored by the vastly different conditions at the adjoining public park to the west. On the park property, a solid concrete wall appeared stable and in its original position, while the poorly constructed and now neglected rock revetment at the Sprague TRT Terminal continued to unravel and appeared to have retreated considerably. The abrupt transition from the solid concrete seawall of the public waterfront park area serving the adjacent neighborhood and the unstable, inadequate, and disarrayed rock present at the Sprague TRT tank farm area appears derisory even to the untrained eye. The failure to maintain this infrastructure is one example of a clear violation of the good engineering practices standard required under the Sprague TRT Terminal's existing permit.

D. Current Permit Standard

74. In my experience, I am familiar with reviewing and applying regulatory language such as that in the 2013 Sprague Quincy Terminal permit ("2013 Permit"), the 2011 Sprague TRT Terminal permit ("2011 Permit") (collectively, "Prior Permits"), and the Draft Permits. In my opinion based on extensive professional work in this domain, plus familiarity with other standards and practices by others, the 2013 Permit and the 2011 Permit adopt a "good engineering practices" standard that requires permittees to anticipate reasonably foreseeable risks, including climate change risks, and to design and construct their facilities to protect the facilities from these reasonably anticipated risks.

75. The Prior Permits set a "good engineering practices" standard for both control measures and creation of the Stormwater Pollution Prevention Plan ("SWPPP").

76. For instance, they state:

> The SWPPP shall be prepared in accordance with ***good engineering practices*** and shall be consistent with the general provisions for SWPPPs included in the most current version of the MSGP.

2013 Permit § I.C.2.c; 2011 Permit § I.C.3.

77. The Prior Permits also state: "The SWPPP shall document the appropriate best management practices (BMPs) implemented or to be implemented at the facility to ***minimize the discharge of pollutants*** in stormwater to waters of the United States and to satisfy the non-numeric technology-based effluent limitations included in this permit. At a minimum, these BMPs shall be consistent with the control measures described in the most current version of the MSGP." *E.g.,* 2011 Permit § I.C.4.

78. The 2015 Multi-Sector General Permit, which the Prior Permits incorporate by reference defines the term "minimize" to mean 'reduce and/or eliminate to the extent achievable using control measures (including best management practices) that are technologically available and economically practicable and achievable in light of best industry practice." 2015 MSGP § 2.

79. The "good engineering practices" standard applies to the description of "all stormwater controls, both structural and non-structural." 2013 Permit § I.C.2.c.iv; 2011 Permit § I.C.3.d. It also requires the permittee to evaluate and identify all potential sources of pollutants. 2013 Permit § I.C.2.c.iii; 2011 Permit § I.C.3.c.

80. By requiring Sprague to use "good engineering practices" to develop and implement control measures, the Prior Permits required Sprague to assess its vulnerabilities in light of climate change, develop engineering design plans to adequately address those vulnerabilities, and ultimately implement measures that will protect the Terminals and other surrounding communities from contamination from the Terminals.

81. Many engineering organizations have been on record in broad and specific ways to include the need to address climate change effects when addressing natural hazard mitigation and

facility design. The list of US and international professional organizations adopting, refining, and promulgating guidance on the issue grows steadily. The Engineering Standard of Care doctrine includes various considerations such as applying higher levels of certainty and lower degrees of risk when addressing human health and safety, as opposed to matters of nuisance or preference. Identifying which data set to use when determining rainfall amounts for hydrologic calculations is part of the engineering process, and there is not one method, but rather an expectation that professionals will use adequately conservative sets of information, including publicly available updates or identifications of known data gaps or shortfalls.

82. The National Academy of Sciences study on Improving the EPA Multi-Section General Permit for Industrial Stormwater Discharges noted:

> Design storm analysis is based on historical data and assumes climate stationarity—the use of previous events to predict those of the future. However, with climate change, historic precipitation records may not capture the full variability or likelihood of future conditions. Forward-looking predictive models may be necessary to properly design future SCMs, considering nonstationarity scenarios.

NAS Study at 70.

83. EPA itself has recognized permittees' duty to assess climate vulnerability in its *Framework for Protecting Public and Private Investment in Clean Water Act Enforcement Remedies*: "[I]t is important for each regulated entity to assess its own vulnerability and consider a range of options that address its particular obligations and goals as well as resource challenges." *Framework for Protecting Pub. & Priv. Inv. in CWA Enf't Remedies*, EPA, at 1-2, https://www.epa.gov/sites/production/files/2016-12/documents/frameworkforprotectingpublicandprivateinvestment.pdf (last visited May 18, 2020).

84. While the EPA may not currently have published tools related to accounting for climate

change and other phenomena such as geostatic rebound which affect relative sea level rise, other more appropriate Federal agencies do. The nation's preeminent engineering organization, the US Army Corps of Engineers, first published sea level rise guidance for designers in 1992, and then made wholesale upgrades to the sophistication and comprehensiveness of their approach in response to Hurricane Katrina during their effort to construct a coastal flood infrastructure system designed to avoid similar future impacts.

85. In a 2013 regulation entitled "Incorporating Sea Level Change in Civil Works Programs," the Army Corps stated:

> [Sea level change] can cause a number of impacts in coastal and estuarine zones, including changes in shoreline erosion, inundation or exposure of low-lying coastal areas, changes in storm and flood damages, shifts in extent and distribution of wetlands and other coastal habitats, changes to groundwater levels, and alterations to salinity intrusion into estuaries and groundwater systems.

Army Corps of Engineers, Regulation No. 1100-2-8162, at Appendix B, B-1 (Dec. 31, 2013).

86. Part of the Army Corps' protocol includes planned regular updates to their methodology and data as science and policy continue to develop. The nation's single largest public works infrastructure investment, the $14 billion greater New Orleans HSDRRS, used the USACE protocol and applied these principles, as have numerous other USACE and non-USACE public and private projects initiated since 2006. I personally interfaced extensively with USACE personnel and engineering staff from ARCADIS, Shaw, TetraTech, and other firms during the conduct of planning, design, and construction management for the HSDRRS program, and can attest to the broad and pragmatic familiarity with the principles and procedures to address predicted future conditions, including those stemming from climate change. After Hurricane Sandy affected the North Atlantic region, it became a federal priority to ensure that not only new engineering projects, but also past infrastructure

investments were systematically managed in a way that adequately accounted for new information corresponding to design performance and failure risks.

87. As explained above, climate change has greatly increased the risks of flooding from precipitation, storm surge, and sea level rise, and the risk continues to increase over time. The potential impacts on human health and the environment of large-scale flooding at industrial facilities are very high. Therefore, any reasonable engineer designing and implementing control measures to minimize the potential for pollution would take these risks into account and implement control measures to minimize the risk of flooding.

88. The Draft Permits retain the "good engineering practices" standard, which it must, to avoid impermissible backsliding.

89. The Draft Permits require that the "SWPPP shall be prepared in accordance with good engineering practices and manufacturer's specifications" and reinforces that the "good engineering practices" standard requires the permittee to "take future conditions into consideration." Draft Permits § I.C.2.b.

90. The Draft Permits provide that:

> The Permittee shall develop and implement a Stormwater Pollution Prevention Plan (SWPPP) that documents the selection, design and installation of control measures, including BMPs designed to meet the effluent limitations required in this permit to ***minimize the discharge of pollutants*** from the Facilty's operations to the receiving water.

Draft Permits § I.C.2.

91. The Draft Permits state that "the Permittee shall select, design, install, and implement control measures to ***minimize pollutants discharged*** from stormwater" and that includes "[a]t a minimum, . . . both structural controls (e.g., OWS, containment areas, holding tanks) and non-structural (e.g., operational procedures and operator training . . ." Draft Permits

§ I.C.1.a.

92. The control measures "must ensure" that certain "non-numeric effluent limitations are met" including: (i) "[m]inimize exposure of processing and material storage areas to stormwater discharges" (ii) "[i]mplement preventative maintenance programs to avoid leaks, spills, and other releases of pollutants to stormwater that is discharged to receiving waters"; (iii) "[i]mplement spill prevention and response procedures to ensure effective response to spills and leaks if or when they occur"; (iv) "[u]tilize runoff management practices to divert, infiltrate, reuse, contain, or otherwise reduce stormwater runoff"; (v) "[e]valuate for the presence of non-stormwater discharges and require the elimination of any non-stormwater discharges not explicitly authorized." Draft Permits § I.C.1.a.

93. The Fact Sheets appropriately makes clear that these "non-numeric effluent limitations support, and are as equally enforceable as, the numeric effluent limitations . . ." *E.g.,* Sprague TRT Permit Fact Sheet at 35.

94. The Fact Sheets also reiterates that "[t]he selection, design, installation, implementation and maintenance of control measures must be in accordance with good engineering practices and manufacturer's specifications and must take future conditions into consideration *E.g.,* Sprague TRT Permit Fact Sheet at 35-36.

II. PROPOSED PERMIT DEFICIENCIES

A. The permit conditions and standards included in Section I.C.1.b.6 of the proposed Draft Permits are less stringent and therefore unlawful under the Clean Water Act's anti-backsliding requirements. See 33 U.S.C. § 1342(o).

95. The Clean Water Act ("CWA") anti-backsliding[1] provision prohibits permits from having

[1] Anti-backsliding "refers to statutory and regulatory provisions that prohibit the renewal, reissuance, or modification of an existing NPDES permit that contains effluent limitations, permit conditions, or standards

less stringent effluent limitations than the previous permit. *See* 33 U.S.C. § 1342(o). Section 402(o)(3) of the CWA is a safety clause that provides an absolute limitation on backsliding:

> This section of the CWA prohibits the relaxation of effluent limitations in all cases if the revised effluent limitation would result in a violation of applicable effluent guidelines or water quality standards, including antidegradation requirements. Thus, even if one or more of the backsliding exceptions outlined in the statute is applicable and met, CWA section 402(o)(3) acts as a floor and restricts the extent to which effluent limitations may be relaxed. The requirement affirms existing provisions of the CWA that require effluent limitations, standards, and conditions to ensure compliance with applicable technology and water quality standards.

U.S. Envtl. Prot. Agency, *NPDES Permit Writers' Manual*, at 7-4 (Sept. 2010), https://www3.epa.gov/npdes/pubs/pwm_chapt_07.pdf.

96. In my experience, I am familiar with reviewing and applying regulatory language such as that in the Prior Permits and the Draft Permit. In my opinion based on extensive professional work in this domain, plus familiarity with other standards and practices by others, the Major Storm Events BMP adopts standards that are weaker than the Prior Permits and contradict the provisions discussed in paragraphs 74-79, above.

97. The language proposed by EPA in Section I.C.1.b.6 violates Section 402(o) by narrowing the scope of the control measures to exclude consideration of all of climate change related impacts, including sea-level rise and storm surge, and by basing a facility's risk designation on Federal Emergency Management Agency ("FEMA") flood risk assessments. As discussed above, the Prior Permits require consideration of all climate change impacts and requires a prospective risk assessment based on good engineering practices. The use of the Base Flood Elevation (BFE) indicated on a FEMA Flood Insurance Rate Map (FIRM) is not adequate for most engineering purposes, and especially not in cases understood to involve

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less stringent than those established in the previous permit." U.S. Envtl. Prot. Agency, *NPDES Permit Writers' Manual*, at 7-2 (Sept. 2010), https://www3.epa.gov/npdes/pubs/pwm_chapt_07.pdf.

life or safety risk. Because the intended purpose of a FIRM is to indicate general property risk in relation to an annual contract with a calculated flood insurance premium, the analysis behind the map does not include long-term forward-looking factors. Specifically, the "current" FIRM for any specific parcel may be decades old and contain outdated topographic conditions as well as stale methods of calculating or modeling rainfall, runoff, watershed hydrology, hydraulics, multiple factors such as wave action, and overall actual flood risk. As of this writing, no FIRM has been published which factors in known rates of local relative sea level rise or any other specific climate change forecast inputs. Also, while any given FIRM may surely be interpreted to indicate those areas most likely to experience flooding, it is also true that more than half of all flood damage ever recorded by FEMA occurs outside of the mapped areas indicating a 1% annual risk of flooding. Thus, the BFE associated with the 1% annual risk of flooding is less than 50% accurate in predicting where floods are prone to occur. As such, the BFE from a FIRM may be useful for initial screening-level assessment in the absence of more accurate information (including to identify the need for more detailed analysis) but it is entirely inadequate to inform engineering where life or safety risk is posed to human health or the environment. The permit conditions and standards in the Draft Permits are less stringent than those in the Prior Permits and therefore adoption of the language proposed in Section I.C.1.b.6 of the Draft Permits is in violation of Section 402(o) of the CWA.

B. The use of FEMA FIRMs as a basis for benchmarking control measures and identifying at-risk facilities is inadequate and a less stringent requirement than the Prior Permits.

1. BFE is a narrowly applicable flood insurance rate-setting metric inappropriate for use as a tool to define engineering standards.

98. As noted in the Request for Comment and footnote 4, BFE "is the computed elevation to

which floodwater is anticipated to rise during the base flood," which is what the Federal Emergency Management Agency ("FEMA") has determined to be the 100-year flood, or the flood with a one percent annual chance of being equaled or exceeded in a given year. Areas that will be inundated in the event of a 100-year storm are designated Special Flood Hazard Areas ("SFHA") on FEMA Flood Insurance Rate Maps ("FIRMs"). However, FEMA created these maps not as a tool for designing facilities and infrastructure to prevent discharge of pollutants by withstanding storms and floods in such areas, but for the purpose of providing federal government subsidized insurance to homeowners with federally insured mortgages. Moreover, the FEMA FIRMs are based on historic data, not forecasts spanning long service lives of complex facilities or infrastructure, and they are infrequently updated.

99. One of the clearest examples of the gross ineffectiveness of relying on FEMA FIRMs to identify the risk of a given facility is Hurricane Harvey. Harvey was a 500-year storm (in the traditional historic context) that devasted the Houston area, a slow-moving onslaught of rain that caught the city unawares and wreaked havoc on Houston homes and industrial facilities alike. Yet Harvey was not the first such storm to pass through Houston in 500 years. In fact, Harvey was *the third such storm in three years* to bombard the area, and it was Houston's very reliance on the 1-in-500 year probability that led the city to inadequately prepare, leading to unnecessary and disastrous consequences. *See* Dara Lind, *The "500-year" flood: why Houston was so underprepared for Hurricane Harvey*, VOX (Aug. 28, 2017), https://www.vox.com/science-and-health/2017/8/28/16211392/100-500-year-flood-meaning ("Tomball, Texas, Public Works director David Esquivel told a local paper there this year that the Houston area had 'two 500-year storms back to back': over Memorial Day weekend of 2015 and early April 2016. That means that Hurricane Harvey constitutes the

third '500-year' flood in three years."). As Lind noted, "Either Houston is incredibly unlucky or the risk of severe flooding is a lot more serious than the FEMA modeling has predicted — and the odds of a flood as bad as the ones Houston has seen for the past few years are actually much higher than 1 in 500." *Id.; see also* Eric S. Blake & David A. Zelinsky, Nat'l Hurricane Ctr., *Tropical Cyclone Report: Hurricane Harvey* 1, 9 (2018), *available at* https://www.nhc.noaa.gov/data/tcr/AL092017_Harvey.pdf (noting that "a majority of the residential flood loss claims [from Harvey] are from outside the 500-year flood plain")

2. <u>The specific references to BFE and SFHA in the Draft Permits constitute unlawful backsliding.</u>

100. The Draft Permits reference "BFE" in two instances. Section I.C.1.b.6.ii and iv suggest using BFE as a height by which to raise or store structures and materials to supposedly protect them from flooding. However, as discussed immediately *supra*, using BFE as a proxy for "safe height" is risky and unsound as an engineering practice.

101. Even if BFE were a valid metric to prevent infrastructure or materials from flooding (it is not), it goes against engineering practice to rely solely on BFE; even minimal standards incorporate some level of freeboard, "a term used by FEMA's National Flood Insurance Program (NFIP) to describe a factor of safety usually expressed in feet above the 1-percent-annual chance flood level." FEMA Factsheet, *Building Higher in Flood Zones: Freeboard – Reduce Your Risk, Reduce Your Premium*, *available at* https://www.fema.gov/media-library-data/1438356606317-d1d037d75640588f45e2168eb9a190ce/FPM_1-pager_Freeboard_Final_06-19-14.pdf.

102. BFE on its own, aside from being unreliable and inadequate, provides no margin of error for common flooding occurrences such as wave action, mobilized debris, and more.

103. This weakening of the permit by explicitly incorporating BFE is particularly concerning because bulk petroleum terminals, like the two Sprague Terminals in Quincy, hold immense potential for devastating results should they flood.

104. Request for Comment suggests further weakening the Draft Permits by using the SFHA to "identify areas of the Facility that are at the highest risk for stormwater impacts from major storms that cause extreme flooding conditions." *E.g.,* Sprague TRT Permit Fact Sheet at 36.

105. As discussed above, FEMA FIRMs were created as an insurance premium pricing tool and were created based on often incomplete historic data that does not take into account recent or future climate change impacts. Visual reconnaissance of the Sprague TRT Terminal in January 2021 revealed evidence of recent and/or ongoing coastal erosion which threatens the structural integrity of the main tank farm containment berm, for example. This active and relevant flood risk factor is not the type of detail a FIRM is intended to indicate, and thus illustrates the type of germane information which is missing from FIRMs and the data they rely upon.

106. As a result, using the FIRMs as a tool to identify risk will miss large swaths of facilities that are currently at high risk of flooding, and ignores that certain facilities may have specific characteristics that make them more susceptible to flooding in addition to their location, namely through erosion, backwater effects, debris jams affecting bridges or pipes, etc.

C. The Draft Permits do not require consideration of ALL climate change-related impacts and therefore impermissibly weaken effluent limitations.

107. Section I.C.1.b.6 of the Draft Permits make no mention of climate change or its associated impacts and unlawfully weakens effluent standards by narrowing the focus of

preparedness to "major storm events that cause extreme flooding conditions," referring to the provision as the Major Storm Events BMP, *E.g.,* Sprague TRT Permit Fact Sheet at 36. While well-meaning, this language not only implies facilities need not consider prospective increases in risk based on increased frequency and severity of storms and sea-level rise, but, combined with the suggestion that FEMA FIRMs are an accurate measure of current risk, the language indicates that risk calculation based on historical data is sufficient to protect facilities, surrounding communities, and the environment in the event of a storm.

108. Moreover, even if the language could be read to include consideration of the increased frequency of storms, both major and minor, and the increasingly severe nature of storms, the Draft Permits still fall short of the Prior Permits because they exclude consideration of sea-level rise and storm surge flooding. Storm surge flooding exacerbates and contaminates stormwater by infiltrating and flooding secondary containment structures and drainage areas, carrying debris that clogs drainage areas and creates backup, and potentially mobilizing heavy objects which may then destroy control measures and/or other structures.

D. The proposed use of temporary measures to accommodate major storm events impermissibly weakens the permit because it ignores that these events have become more frequent and have increased in intensity and implies that more permanent measures are unnecessary.

109. Sections I.C.1.b.6.iii-vi weaken the Draft Permits by identifying temporary measures to be taken only in the event of an oncoming storm. Such temporary measures presuppose that i) storms will be infrequent enough to make temporary measures sustainable on a regular basis, ii) facilities will be able to predict in advance and with certainty which storms will pose a flooding risk, and iii) permanent infrastructure (such as warehouses for storing or roads for transporting necessary materials or equipment) is already out of harm's

way in the event of a flood.

E. Necessary Improvements in Proposed Language to Avoid Backsliding

110. Floodplain management is not simple, and attempting to define flood risk based on a BFE line drawn on a FIRM has long been known by those familiar with relevant issues to be inadequate for many tasks, such as those arising under NPDES permit review. Fortunately, a great deal of information and methodological tools are available to assure that good engineering and design practice will responsibly address flood risk in a changing climate on a suitably informed and rigorous basis.

111. A comprehensive push to assemble lessons learned concerning flood risk management over decades of assessing and responding to storm damage culminated in the 1994 report, A Unified National Program for Floodplain Management (https://www.fema.gov/media-library-data/20130726-1733-25045-0814/unp_floodplain_mgmt_1994.pdf). While this document is not an example of the latest thinking on climate change, it is considered an important foundational analysis by many experienced professionals in flood hazard management, capturing the type of nuanced, ground-truthed understanding, informed by lessons learned, which should be applied today (and which is neglected at our collective peril). One of several important contributions of this seminal report is the idea that hazards are complex and interconnected, and analysis of flood risk requires multi-hazard, multidisciplinary technical approaches to adequately address this reality. The words of the Forward to the 1994 report highlight key themes such as prioritizing hazard mitigation (as opposed to costly disaster response) and improving technical standards, noting that issues such as wind and coastal erosion are known to defy and even alter what may appear on a FEMA floodplain map:

“In the 25 years since Congress first called for a unified national program to reduce flood losses, the Nation has made great progress in:

• recognizing the wide range of human and natural resources that are at risk in floodprone areas;

• accepting nonstructural mitigation measures as cost-effective components of floodplain management efforts;

• assessing the status of floodplain management in the United States and using those evaluations as a foundation for improvement of management approaches and measures; and

• achieving experience with and acceptance of mitigation as a principal means of reducing losses.

“However, the floods and severe storms of the last few years have been a sobering reminder of work yet to be done to further reduce the vulnerability of the residents of the United States to extreme natural events, and to more closely safeguard the valuable natural resources and functions that are found within the Nation's floodplains.

“The Nation is entering a new era in hazards and emergency management--one in which a comprehensive multi-hazard, multidisciplinary approach, a stronger emphasis on mitigation, and use of technological tools like geographic information systems, will play leading roles. This updated Unified National Program for Floodplain Management can be a benchmark for that new era. Management of flooding and, more recently, of floodplains, has been an important focus of programs within numerous Federal and state agencies for many decades. The considerable achievements of the floodplain management community in devising a conceptual framework, establishing intergovernmental coordination, cooperating with the private sector, improving technical standards, conducting evaluations of progress, and setting long-term national goals, are reflected in this document. Yet none of the methods or goals presented here is incompatible with a much-needed and broader multi-hazards mitigation approach. In fact, some technical and regulatory standards for flood risks are already being developed in conjunction with those for other hazards, notably wind and coastal erosion. This Unified National Program for Floodplain Management points the way for effective all-hazards management and mitigation on a national scale"

112. Another keystone document in modern applications of federal risk management decision-making in floodplain environments, is Executive Order 11988 which represents a major step forward in articulating the consensus of the need to approach flood hazards going beyond looking at lines on a map, and instead reflecting that such lines (namely those indicating a BFE) do not represent areas of "risk vs no risk" but rather an estimated delineation between a roughly calculated 1% annual flood risk and adjacent areas of remaining risk. Also, E.O. 11988 does a thorough job of defining the merits and frameworks for applying different degrees of risk management based on the type of facility in question. Thus, it is appropriate to interpret this document and its related implementation documents as a record of good engineering practices based on interpretation by multiple federal agencies and industry groups involved in the topic. With this in mind, page 41 of the Guidelines for Implementing E.O. 11988 and E.O. 13690 (https://www.fema.gov/media-library-data/1444319451483-f7096df2da6db2adfb37a1595a9a5d36/FINAL-Implementing-Guidelines-for-EO11988-13690_08Oct15_508.pdf) offers a succinct description of the importance of even small chances of flooding warranting greater scrutiny

when it comes to critical facilities and related actions as it directs federal agencies

> to consider critical actions in more detail as a means to minimize risks posed to those actions that must occur in a floodplain. Critical actions include any activity for which even a slight chance of flooding is too great. The concept of critical action reflects a concern that the impacts of flooding 42 Guidelines for Implementing E.O. 11988 and E.O. 13690 on human safety, health, and welfare for many activities could not be minimized unless a higher degree of resilience was provided.

113. Consistent with the legal requirement to prevent pollutant discharges, the Draft Permits must consider and address the well-known concept of resilience to flooding and severe and extreme weather impacts. The proposed language in Section I.C.1.b.6 takes a step backwards in the direction of engineering design targeted at functional failure (rather than prevention of foreseeable pollutant discharges), such as by inundation, erosion, or other functional compromises which are likely to arise by adopting BFE as the reference elevation. In general this narrow-eyed approach to engineering (which is not focused on Clean Water Act compliance) typically fails to incorporate resilience-based considerations for how, and under what conditions, an engineering design can continue to perform some functions, even if other functions may have reached their "failure point", thus providing an added measure of risk management beyond the purported 1% annual flood event. An example of addressing resilience might be engineering a structure so that it becomes inundated (losing the function to prevent flooding) but remains resistant to erosion (hence able to perform reasonably well or with minor repair during the next storm). In addition to the flawed focus on "failure points", proposed Section I.C.1.b.6 appears to reflect an absence of focus on the intention to avoid or minimize opportunities for engineering designs to result in catastrophic failure. An example of which could be a berm or levee seeking to protect an industrial facility used for hazardous material storage and related manufacturing without

considering resilience or whether retreat or substantial facility modification is warranted in the face of known risks. The Draft Permits must specify steps for considering failure beyond basic performance levels and assessing and avoiding catastrophic failure modes.

114. Common approaches to addressing chronic and/or cumulative impacts of extreme weather and sea-level rise focus on periodic visual assessment and monitoring of key features such as berms to guide maintenance and/or upgrade actions. Likewise, field assessment after catastrophic events such as major coastal storms is considered a standard approach to guide actions to restore functionality quickly after damage is sustained. By extension, documenting and assessing storm damage degree and frequency provides part of a sound basis for decision-making about ongoing risk of damage capable of causing catastrophic damage. In light of the important recent attention on functional resilience (which typically involves adapting over time to observations and forecasts), neglecting such steps would constitute a violation of the good engineering practices standard established by the prior permits and any effort to limit those duties would amount to impermissible backsliding.

115. Given the realities of climate change, good engineering practice at industrial facilities must include a robust analysis of pollutant spill and discharge pathways associated with severe weather, increased frequency and magnitude of flood events, storm surge and related hazards for coastal facilities, and sea level rise over the design life of installed and operated proposed infrastructure. Based on this analysis, the Draft Permits should require SWPPP components targeted at design, operation, and maintenance of facilities to prevent pollutant discharges through floodproofing measures including incremental or immediate retreat where necessary. The measures identified in the SWPPP must be implemented over

the timeframe necessary to prevent discharges and protect public health safety and welfare.

116. The type of required ongoing analysis of risks posed by changed conditions is evident in the designs of the two Terminals. The Sprague Quincy Terminal reveals a higher standard of engineering and maintenance of its containment berms than what could be observed at the Sprague TRT Terminal (though full data collection and analysis has not been possible, and compliance with engineering standards is not implied). The engineering criteria which appear to have been employed at the Sprague Quincy Terminal (shoreline structure design height, materials and methods of construction, and degree of ongoing maintenance/performance) are significantly higher than what is visible at the Sprague TRT Terminal. These differences in initial design are to be expected given the differing ages of the two facilities. The Sprague TRT Terminal is based on the century-old engineering practices common when constructed, whereas the circa 1970s engineering practices evident in the Sprague Quincy Terminal appear to reflect more evolved standards for waterfront critical infrastructure facilities (although not necessarily up to date with current standards). For example, since the 1970s (especially in the aftermath of the Blizzard of '78 which stood as the storm of record for Massachusetts until recently and struck soon after the original design plans were prepared for Sprague Quincy Terminal), what is considered acceptable as "good engineering practices" has continued to evolve. Further underscoring the need to track and adapt to changing sea levels, storm surge effects, and storm intensity/duration, four severe winter storms affecting Massachusetts struck the coast in quick succession in the first quarter of 2018, leaving little time for repair or other adjustments to operations and preparations. The January 2018 storm named Grayson exceeded the storm surge levels set in 1978, and the March 2018 storm named Riley ranked third, peaking at about an inch

lower than the longstanding record of 1978. Good engineering practice requires that the Terminals update the design and operation of facilities to take into account both known recent threats, as well as anticipated future trends.

117. To assure adequate design, operation, and maintenance of facilities, applicants must be required to assess and address system level or network effects. Without consideration and development of management practices to address resilience at the system level, facilities will continue to be at severe risk of flooding and pollutant discharges, including catastrophic discharges. For example, the approach proposed in Section I.C.1.b.6 could result in the risky and flawed "dry socket approach" where a site may be designed to be kept dry by effective performance of a flood control levee, but have no dry road access for workers, first responders, or other emergency personnel to use for access to the site to perform preparation, operations, or response. Not only is this an example that falls far short of good engineering and design practice, but these flawed engineering approaches run a very high risk of failure, in particular catastrophic failure, especially as infrastructure ages and deferred maintenance risks increase. Another foreseeable example under the approach proposed in Section I.C.1.b.6 would be that electrical power service is lost, and concurrently backup power is also lost. Such events are not rare, and a backup generator used for floodwater pumping or other purposes may either experience random mechanical failure, or commonly may experience stored fuel supplies washed away by wave action, contaminated with water by debris puncturing tanks or supply lines, or otherwise being affected by the very storm conditions the equipment was intended to handle.

118. The Draft Permits should specify addressing redundancy and/or alternative measures of enhancing reliability, efficiency, and/or self-sufficiency to improve functional reliability

under multi-hazard scenarios related to extreme weather. Instead of adopting a fixed (and flawed) base flood elevation as proposed in Section I.C.1.b.6, EPA should mandate that where there is a risk of pollutant discharges, consistent with good engineering practice the SWPPP must include specific identification of short-term and long-term measures to address both immediate concerns as described in paragraph 117 as well as longer term, permanent solutions to assure that at-risk facilities do not continue to present a substantial risk of pollutant discharges and to public health and safety. Near term measures should include:

a. design of berms and other flood-proofing measures to an elevation necessary to account for site specific flood risks taking into consideration sea level rise, storm surge, extreme precipitation and other reasonably foreseeable risks;
b. Mandatory maintenance of dry, safe access to the facility during reasonably foreseeable events; and
c. Maintenance of backup generation and on-site or adjacent renewable energy (such as wind or solar PV) to perform the most critical functions required for emergency operations.

119. As both a near-term measure in severe instances and as a longer-term measure to assure that pollutant discharges are reasonably managed, the Draft Permits must incorporate the consideration of retreat into the assessment. Retreat may take the form of small but meaningful adjustments to the position of facilities on site, or where warranted retreat may take the form of moving facilities, or their key elements, to a new site. Retreat is often thought of in “map view” where the movement is horizontal, retreating laterally from the known hazard(s). However, retreat can at times be highly effective when it involves a

change in vertical position to be above anticipated flood and/or wave levels, such as raising the site elevation through fill, building elevated on pilings, or by moving facility elements to higher ground levels on the same site. Another form of retreat involves establishing a master plan of temporal risk reduction, such as closing flood gates as extreme weather approaches, removing high-hazard materials from a facility during hurricane season, or even developing a decades-long plan of phased and/or sequenced measures over time to gradually remove high-risk activities from high-hazard sites. An example could be operating an existing refinery process outside of hurricane season for the multi-year period necessary to implement the construction of a new facility in a low-hazard location to handle the same process year-round at high efficiency. In any case, good engineering and design practice based on readily available data and methods demands that SWPPPs must reflect planning and action to address the foreseeable risks of severe weather, sea level rise, storm surges and extreme precipitation. Unfortunately, we are regularly seeing and experiencing the unfortunate results of past engineering decisions that have not considered these now well accepted realities – often with tragic and catastrophic results. Good engineering and design practice dictates a different result moving forward.

120. Managing severe flood risks can never be handled effectively at the site scale; it is best achieved at the appropriate system level, such as watershed-scale, harbor-scale, community-scale, etc. Otherwise pollutants may not only be released from an inadequately resilient site with brittle or failure-prone measures which have not accounted for the current known risks and scenarios, those pollutants and other storm damage related impacts may then enter or otherwise affect vulnerable areas which similarly lack suitable engineering features to protect them. The Draft Permits should specifically call out the need to take the

issue of surrounding vulnerabilities into account.

121. Lastly, to define good engineering practice, I recommend use of the "Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects" as adopted and periodically updated by the US Army Corps of Engineers (https://www.wbdg.org/ffc/dod/engineering-and-construction-bulletins-ecb/usace-ecb-2018-14). The Draft Permits should make use of the forward-looking information and step-wise analysis and design guidance contained in this and similar and/or future documents on the subject.

I swear, under penalty of perjury, that the foregoing is true and correct to the best of my knowledge.

Wendi Goldsmith

Wendi Goldsmith, PhD

Executed on 2 February 2021